UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S)	John M. Belcea	GROUP ART UNIT:	2683
APPLN. NO.:	10/799,398	EXAMINER:	Le, Danh C.
FILED:	March 12, 2004		
TITLE:	A System And Method For Analyzing The Precision Of Geo-Location Services In A Wireless Network Terminal		

INVENTOR'S DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This declaration is submitted to establish conception of the subject matter of the present application in the United States or other provincial region permitted by the Rule prior to the effective date of United States Patent Publication No. US 2004/0198254 filed on 23 January 2003 entitled "Mobile Body Communication Device" to Mizui (Mizui application), and diligence to the filing of the present application (constructive reduction to practice) from a time prior to the earliest effective date of the Mizui application, 23 January 2003, to the effective filing date, 14 March 2003, of the present patent application.

In support of this declaration, I, John M. Belcea, of West Melbourne, Florida, declare and sayeth the following:

That the claimed subject matter of claims 1-5, 7-12, 14-19, and 21 of the instant patent application stands subject to a rejection under 35 U.S.C. 102(e) as being anticipated by United States Patent Publication No. US 2004/0198254 filed on 23 January 2003 entitled "Mobile Body Communication Device, and that the claimed subject matter of claims 6, 13, and 20 of the instant patent application stands subject to a rejection under 35 U.S.C. 103(a) as being unpatentable over United States Patent Publication No. US 2004/0198254 filed on 23 January 2003 entitled "Mobile Body Communication Device;

That the claimed subject matter of the instant patent application was conceived in the United States or other provincial region permitted by the Rule before the effective date (23 January 2003) of the Mizui application in the course of employment by MeshNetworks Inc., the assignee of record at REEL/FRAME 015149/0955;

That the claimed subject matter of the instant patent application was conceived on November 8, 2002; and documented in an activity report for the week of November 18 to November 29, 2002 which is before the effective date (23 January 2003) of the Mizui application;

That the claimed subject matter of the instant patent application was further documented in a user manual entitled "WDEP 0.1: WR deployment tool for Windows" on December 11, 2002 which is before the effective date (23 January 2003) of the Mizui application;

That the claimed subject matter of the instant patent application was the subject of a written invention disclosure based upon the documented activity report and the user manual prepared and submitted on February 19, 2003, with diligence, to a patent committee of MeshNetworks Inc., the assignee of the instant patent application, for the purpose of documenting and evaluating invention disclosures for patent protection;

That, after consideration of the written invention disclosure by the MeshNetworks Inc. patent committee, a provisional patent application 60/454,332 was prepared with diligence by or on behalf of an attorney or agent of the assignee based on the subject matter of the written invention disclosure, and that the provisional patent application 60/454,332 was filed with the United States Patent Office on March 14, 2003;

That the present patent application was prepared with diligence by or on behalf of an attorney or agent of the assignee based on the subject matter of the provisional patent application 60/454,332, and that the present patent application was filed with the United States Patent Office on March 12, 2004 claiming priority to the provisional patent application 60/454,332.

That the attached written activity report, written user manual, and written invention disclosure are all true copies of the original written activity report, written user manual, and written invention disclosure on which the instant patent application is based;

That the conception date (MPEP 715.07) on the attached written activity report and the written user manual and as documented within the written invention disclosure is before the 23 January 2003 effective date of the Mizui application; and

That all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE:

John M. Belcea April 14, 2006

Activity report from November 18th to November 29th,2002.

John Belcea

This week I continued the development of the tool for WR deployment adding links between the configuration parameters, testing and debugging new and old features. Were added new features for importing street data and for computing quality map for street area only.

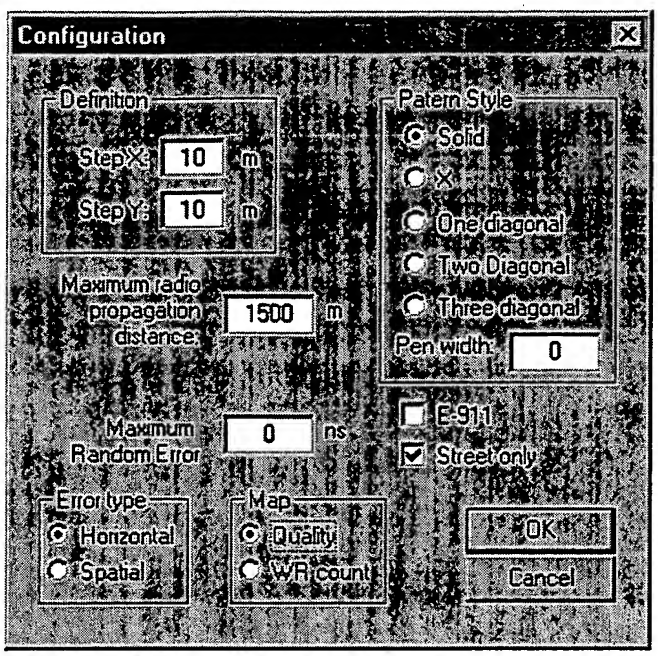


Figure 1 - Configuration Box

The computation runs much faster. After adding or removing a WR, the computation of the new map takes about 5 seconds.

Trying some testing examples I found something strange. The map in Figure 2 shows a city with four avenues (A, B, C, and I) from East to West and 5 streets (1, 2, 3, 4, 5) from North to South. The active WR are in back color. Along Interstate I, all active WR in a perfect straight line. Also WRs on streets 1, 3 and 5 are almost in straight lines. The map shows a very peculiar precision variation along those streets, even if no random error is considered. I identified that the shape and color of these stripes depends on two cutoff values that are used for controlling the computation of location. The quality color code corresponds to E-911 requirements, with green and yellow as acceptable errors, and red and blue as not acceptable.

The map in Figure 3, shows the precision after activating the WR I.4 located on the bottom of picture at (-81.362119, 28.600050). This router is about 5 m off the straight line connecting all other routers. The precision around I.4 has been changed dramatically and 3rd street is fully covered now with errors smaller than 100 m. The size and shape of the change depend on these two values. Since these values are selected arbitrarily, I have second thoughts about criteria used for minimizing the errors. I have no solution yet to this paradox.

The map in figure 4 shows the same precision, but the computation was limited to street width only. As result the computation is much faster in this case.

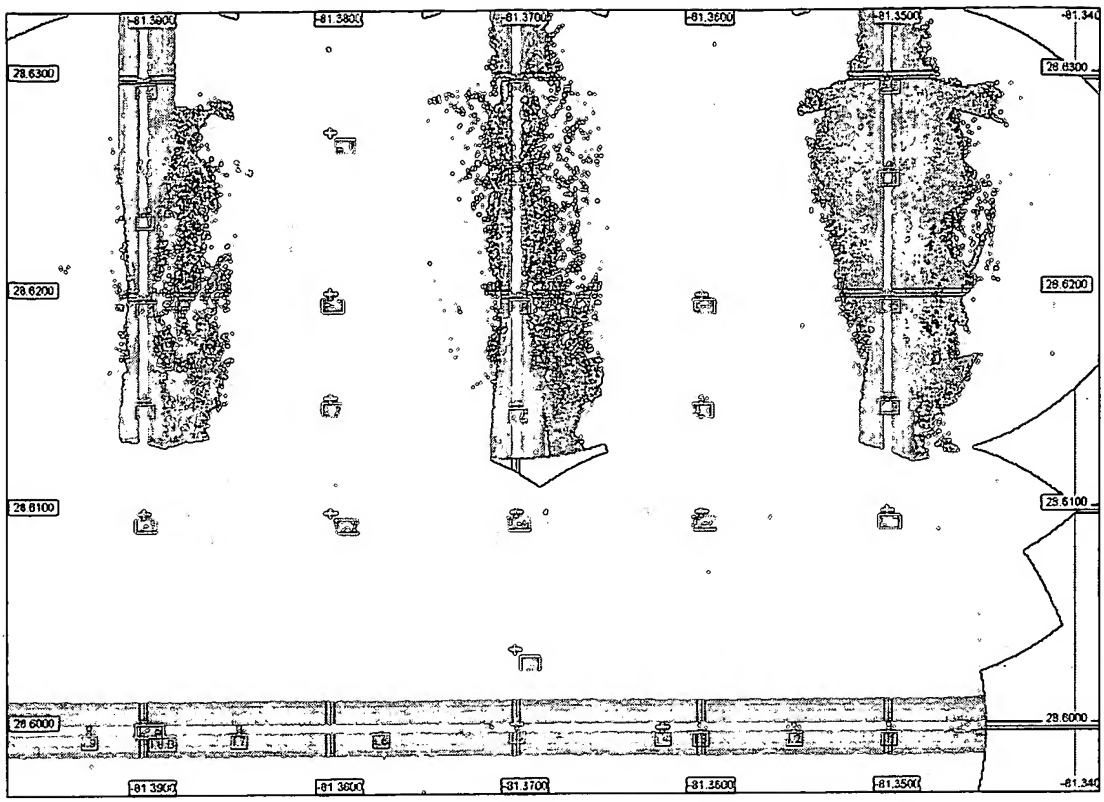


Figure 2 - Initial precision map

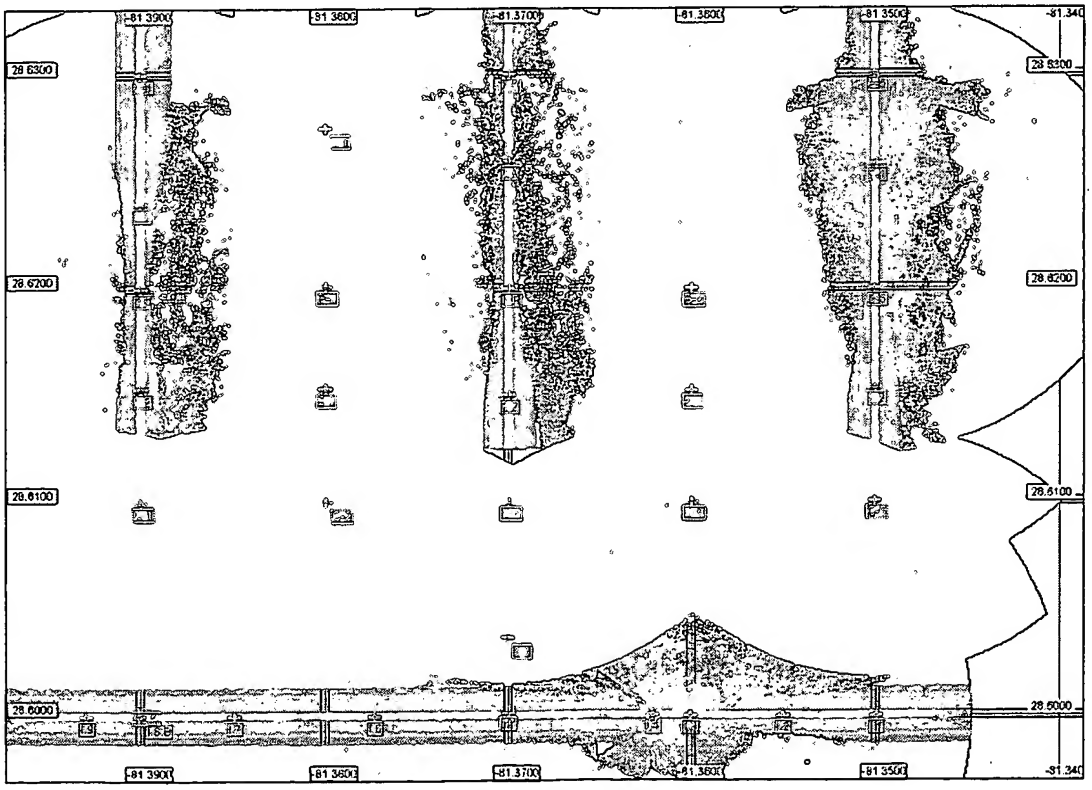


Figure 3 - Active WR I.4

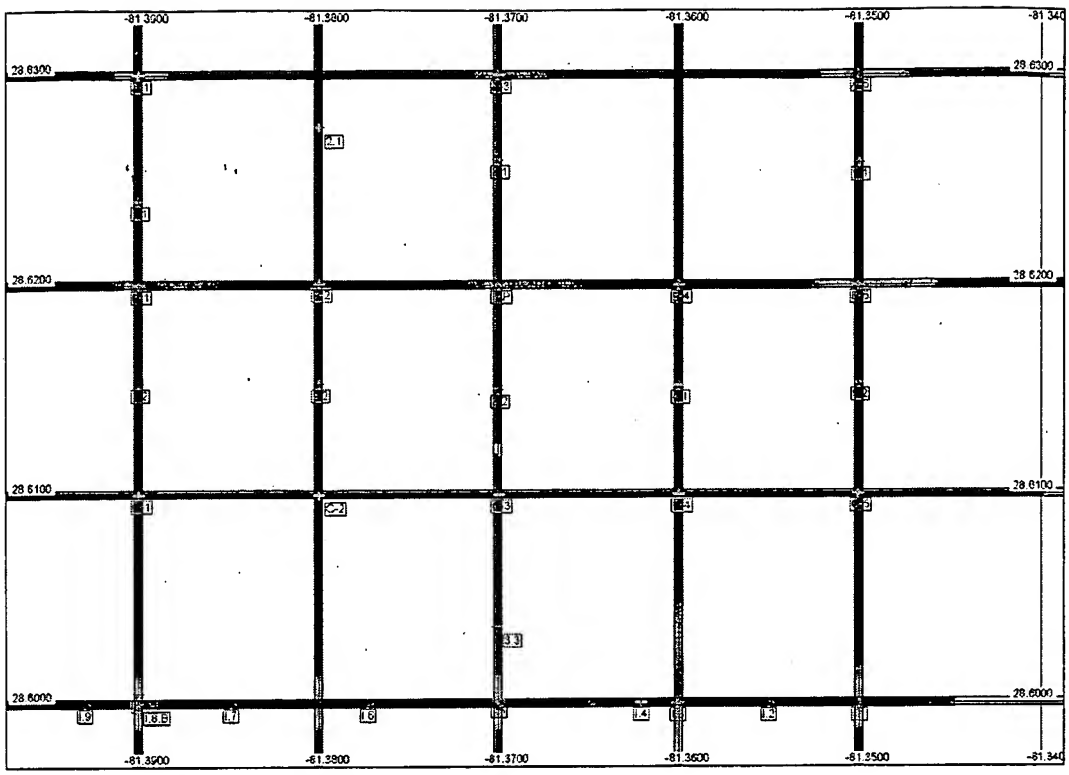


Figure 4 - Street coverage

WDEP 0.1

WR deployment tool for Windows.

User manual

John Belcea
December 11, 2002

1 Introduction

WDEPL is a tool that identifies the quality of location services based on WR/IAP and SD locations.

The quality, as estimated error at location, is presented as a map color coded.

The WDELP tool uses for computation the same fixed point subroutines as MEA, thus it provide results affected by exactly the same errors.

The tool is used by infrastructure planners for identifying effect of WR/IAP location on quality of GEO services supported by infrastructure.

As typical use, the planner decides several alternated locations of the same WR/IAP and enables only one of them. Disabling/enabling WR/IAP, the planner can identify effect of router locations on quality of GEOLOCATION. The tool allows to change on line the position of a router, to add a new router and to remove a router. Routers that have been moved, can be returned to the initial position pressing a button.

2 Installation.

For installation, the WDEPL.EXE file can be copied in any folder and use WINDOWS functions for creating links to application on the desktop, to import the link in a launch bar or in the Start Menu. Also, the application can be started by clicking following link:

\\Dc1\Departments\Engineering\Task Groups\Geo\WDEPL\wdepl.exe

During the execution, the application creates and maintains the WDEPL.INI file in WINDOW folder. The file contains the latest configuration settings that will be used next time when the application is started.

3 Quick start

After is started, the application shows an empty window. It has a menu in top and a tool bar combined with status baon the bottom.

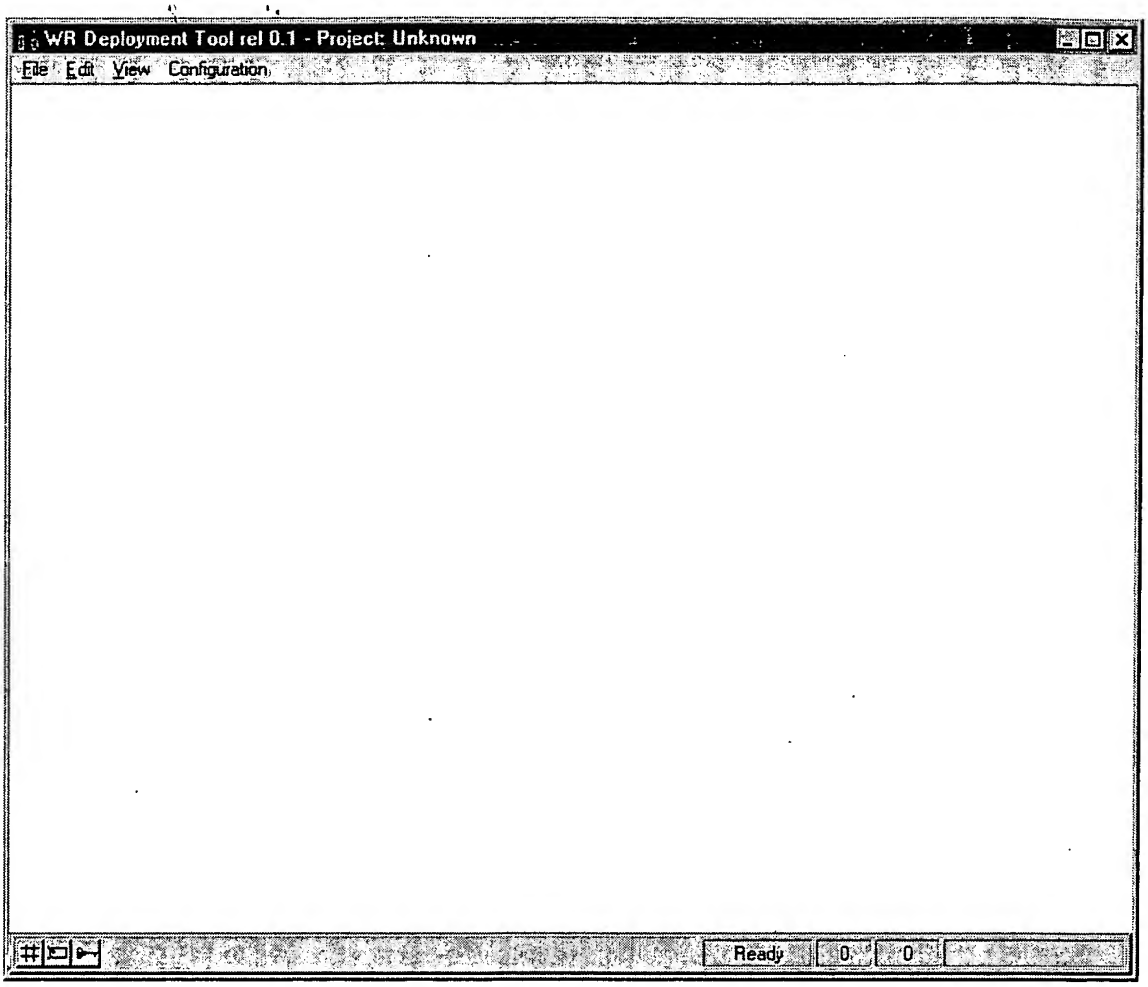


Figure1 - Main Window

4 Menu

The menu has four entries: File, Edit, View and Configuration.

4.1 File

4.1.1 New

4.1.1.1 Project

This menu entry is used for creating new empty projects. A new project does not have any WR or street information.

4.1.1.2 Router

When this entry is selected a new router is created. Router coordinates are in the middle of the current and it has a height of 7 meters. The name of the new router is "New Router" and it is initially disabled. The "WR data" dialog box also activated and the router can be moved to a new position, can be renamed and enabled.

4.1.2 Load project

When this entry is selected for loading an existing project. If the currently active project has changes, the user is asked if wants to save the current work. The "Open project" dialog box is then opened.

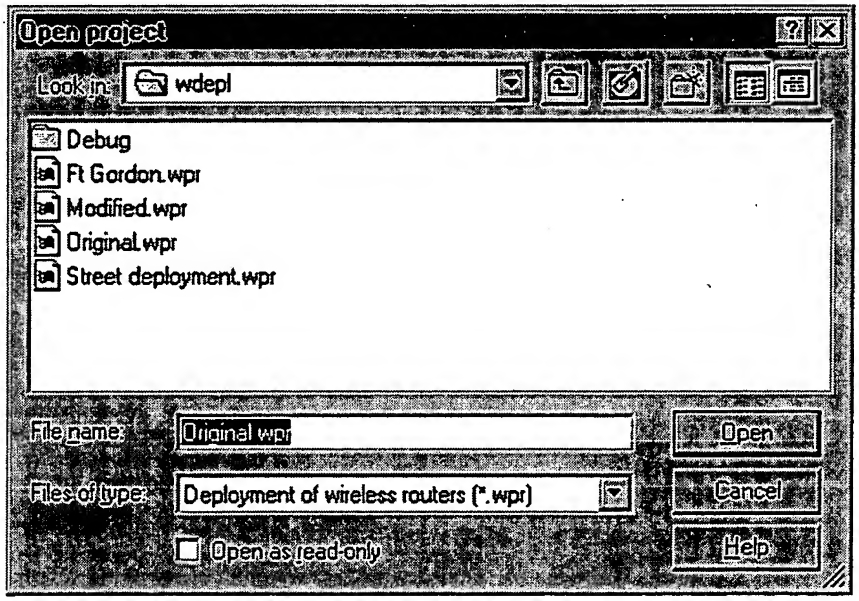


Figure2 - Open project

With this dialog box the user can select a project from local drive or from LAN.

4.1.3 Import router data

This entry is used for adding router data to the current project. When the menu entry is selected, the dialog box "Import Data for Wireless Routers" is displayed:

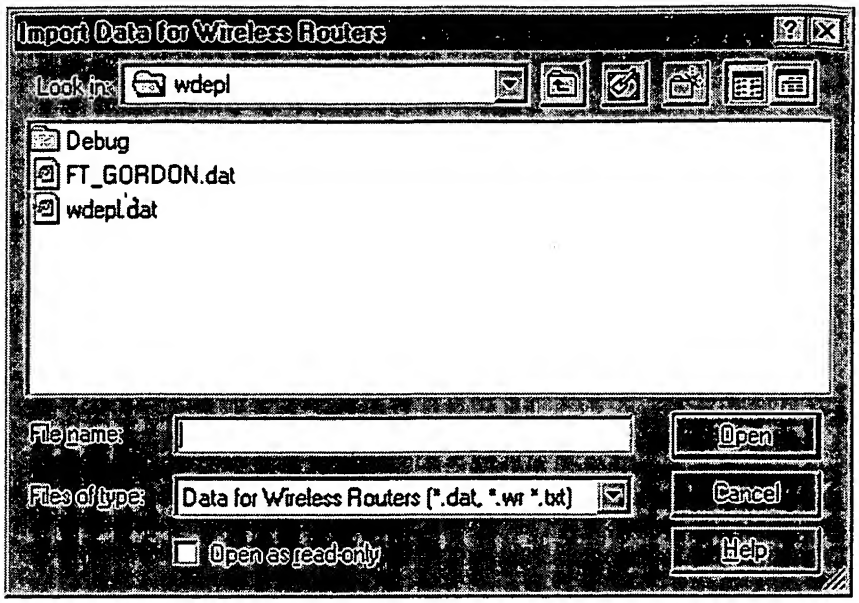


Figure3 - Import router data

The list of files selected with this dialog box contains information about wireless routers: longitude, latitude, antenna height and a description of less than 32 characters. The fields are separated by at least one space or tab characters.

```
#  lon          lat          height(m)    description
-81.36398       28.62299        7         6043735    Antonio's restaurant
```

Clicking on the Open button will import data about all routers in the selected file. Imported data is added to already existing routers.

4.1.4 Import street map

This entry is selected for importing data about street in planning area. A street map is imported only for speeding up the computation process and when the quality of the GEOLOCATION is important only on street only, not within blocks between streets.

When the menu entry is selected, the dialog box from figure 3 is displayed allows to add new street information to the current project.

```
#                              STREET LIST
#     from                     to
#lon          lat          lon          lat       width        Description
-81.3655     28.637       -81.3655     28.600    40        Maitland Ave & US Hwy 17
```

Each line in this file contains the description of a street. The information are the geographical coordinates of both ends of the street, street width and a description of not more than 32 characters.

4.1.5 Save project

This menu entry is used for saving the current project.

The name of the project is displayed in the title bar of the main window. A new project (created with "New Project" menu entry) does not have a name. If the project does not have a name yet, "Unknown" is displayed instead. If any change has been done to project, the name of the project in

main window title bar is followed by a star. After the project is saved, the star is removed from the title bar.

If the user chooses to save anunknown project, the tool activates the dialog box shown in Figure 4.

Figure4 - Import street data

4.1.6 Save project as

This menu entry is use for setting or changing the name of a project. When activated, the following dialog box isdisplayed:

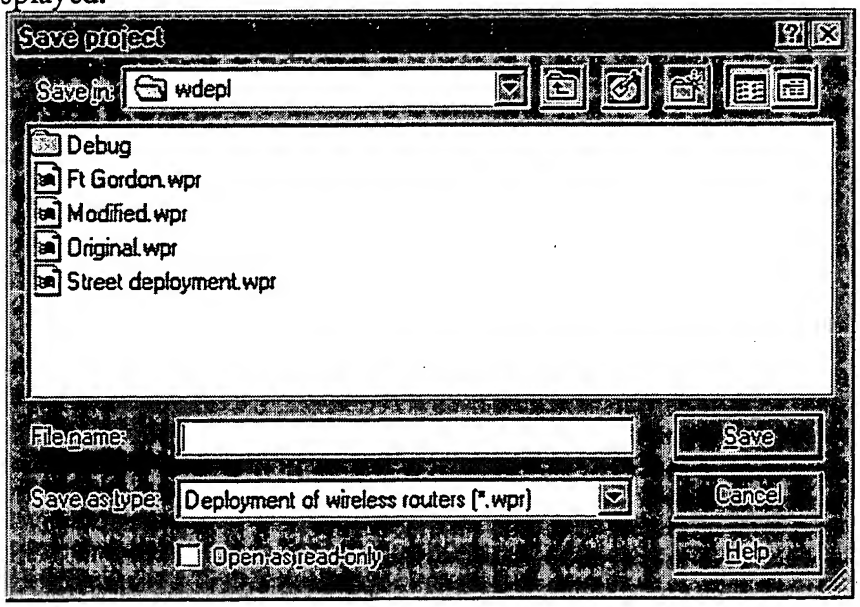


Figure5 - Save project.

The user has to type in the name of the project and click the Save button.

4.2 Edit

4.2.1 Copy

This menu entry is used for copying project image from screen to Windows clipboard as a device independentbitmap (DIB). From there, the picture can be imported in a document, presentation, etc.

4.2.2 Delete router

This menu entry is used for removing the currently selected router. For selecting a router, click on router sign. The WR Data dialog box is opened, showing the information about the currently selected wireless router.

4.3 View

4.3.1 Labels

With this menu entry, the view of the routers labels can be turned on and off. The same effect can be achieved by pressing the label button in the tool bar.

4.3.2 Grid

With this menu entry the view of geographic grid. The same effect can be achieved by pressing the grid button in the tool bar.

4.3.3 Legend

This entry is used for displaying the legend window. The legend window can also be displayed by pressing the legend button in the tool bar.

4.4 Configuration

The Configuration menu entry is used for displaying the "Configuration dialog box.

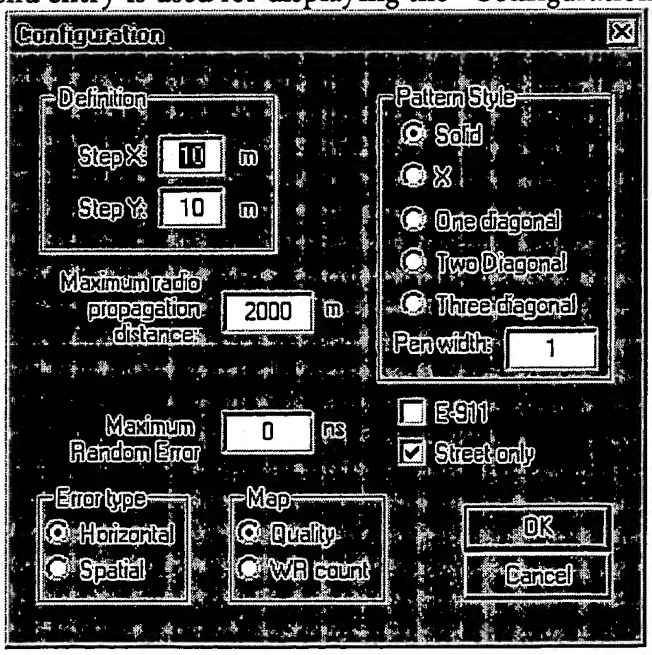


Figure6 - Configuration

4.4.1 Definition

The specified area is divided scanned according with the Definition. In each point computed the distance between the true position and the position provided by LS algorithm. It is considered the error of the algorithm and plotted in a specific color as a rectangle.

4.4.1.1 Step X

This entry is used for setting the distance between two points on the East-West (OX) direction.

4.4.1.2 Step Y

This entry is used for setting the distance between two adjacent points on North-South (OY) direction.

4.4.2 Pattern style

The rectangle can be filled with the color corresponding to the error of distance using different weight patterns. The Solid pattern covers completely the scanning rectangle and is 100% opaque. Other patterns provide various levels of transparency, that depends also on the size of the scanning rectangle.

4.4.3 Maximum propagation distance

The radio propagation is supposed to be the same in all directions. With this entry, the user can set the limits of communication for GEOSERVICES purposes. Because GEOLOCATION requires a communication link with a reliability not smaller than than 10%, the propagation distance for this service is much larger than the propagation distance for data transfer which requires at least 90% link reliability.

4.4.4 Maximum random error

The Time Of Flight (TOF) is affected by random errors. This entry sets the maximum error that can affect the TOF. It is suggested that this error is 350 ns for outside building services and 1000 ns for inside buildings services. It is expected to lower this limits about 10 times, after the improved TOF is implemented.

4.4.5 E-911

The error map can be drawn with high or low precision. If this box is checked, the map shows error from 0 m to 250 m, which makes easy to identify if E911 requirements are met. If this box is not checked, the map shows errors between 0 m and 25 m.

4.4.6 Street only

This check box is available only if the project contains street data. When it is checked, the location errors are computed only for street area. It allows the computation to be performed much faster.

4.4.7 Error type

The displayed error can be the distance between the true point and computed point in two dimensional (horizontal) or in three dimensional space.

4.4.7.1 Horizontal

When this button is checked, the map shows the distance between the true position and the computed position in horizontal plane.

4.4.7.2 Spatial

When this button is checked, the map shows the distance between the true position and the computed position in three dimensional space.

4.4.8 Map

The tool can show the map of errors and the number of routers that can be received in any scanned point.

4.4.8.1 Quality

When this button is checked, the map shows the distances in scanned area.

4.4.8.2 WR count

When this button is checked, the map shows the number of routers that can be received in any point of the scanned area.

4.4.8.3 OK button

While the Configuration dialog box is open, the computation is stopped. Clicking OK button will change the configuration according with actual settings and will close the dialog. If any of the configuration settings were changed, the computation starts from the beginning.

4.4.8.4 Cancel button

The Cancel button is used for closing the dialog box without updating any configuration elements.

5 Tool bar

The tool bar has three buttons.

The first button  can be used for controlling the display of the map grid.

The second button  can be used for controlling the display of the WR labels.

The third button  lunches the Legend window.

6 Status bar

The Status bar shows on he right side four indicators of computation progress.

In the first indicator shows "Computing", "Patching" and "Ready".

The "Computing" indicator is displayed when the program computes data for the whole map.

Enabling or disabling a WR, causes to compute a "patch" including the WR and covering an area up to the propagation distance. The "Patching" text is displayed when the program computes a patch of the map.

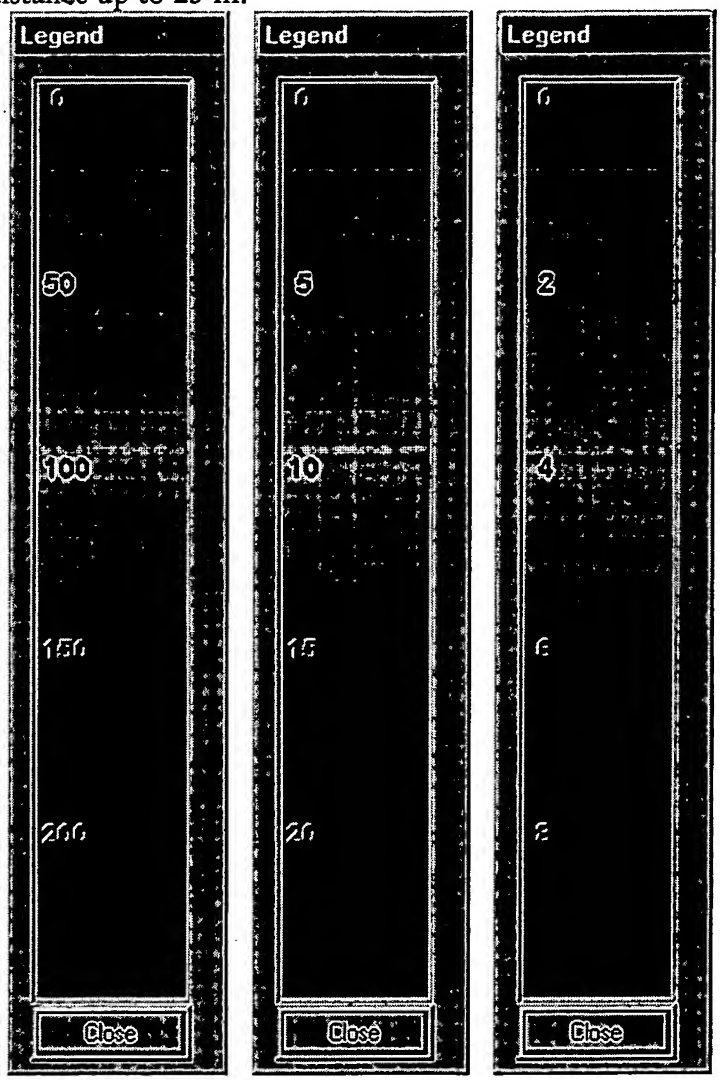
The second indcator shows the element that is computed. When the program computes the whole map, this indicator shows "Main". When the program computes a patch, the program shows the number of the patch that is computed at the time.

The third indicator shows the percentage of the currently executed computation.

The last indicator is a progress bar showing the level of completion of the currently executed computation.

7 Legend window

The scale of the Legend window depends on map type. The legend for maps of location quality with E911 flag on, shows distances up to 250 m. The Legend for maps of location quality with E 911 flag off, show distance up to 25 m.



The Legend for WR count maps shows values up to 10 counts. In all cases values equal or larger with the maximum vale are presented in red color.

8 Working with the application

The folder\\Dc1\Departments\Engineering\Task Groups\Geo\WDEPL\ contains a set of files that can be used for testing the tool.

When starting the application, because no data is available, the screen is blank.

For creating the first project, import WR data from provided file WDEPL.DAT. Click on File→Import router data, then chose the file WDEPL.DAT containing WR data.

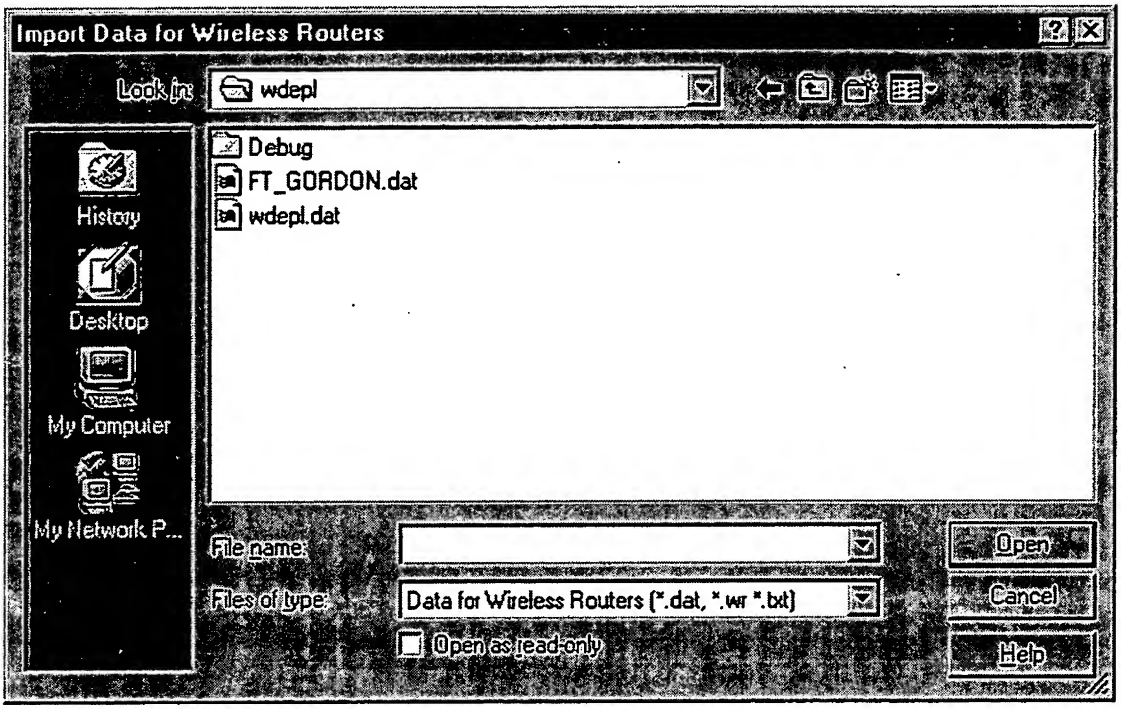


Figure7 - Import WR data

After reading the WR description file, WDEPL shows the routers and the geographic grid. This particular file contains the positions of WR on the demo route used in spring of 2002.

You can change configuration parameters during the computation of the map. If your change affects the way the map is displayed, the map computation will start from the beginning. Resizing the WDEPL window should also cause restarting of map computation.

The window title bar shows the release number of WR deployment tool and the project name. If the current project was modified, an asterisk is displayed next to project name.

You can chose Save or Save As for saving the project.

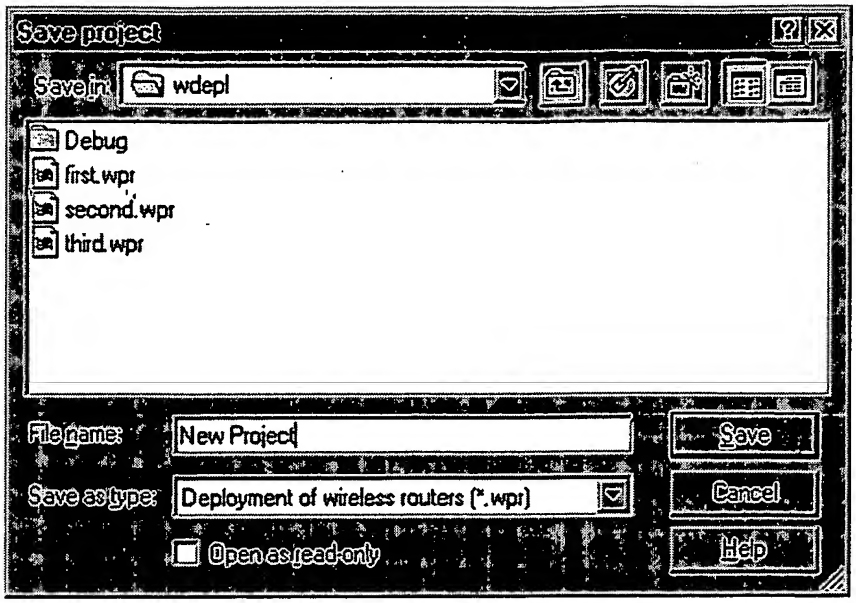


Figure 8 - Save project

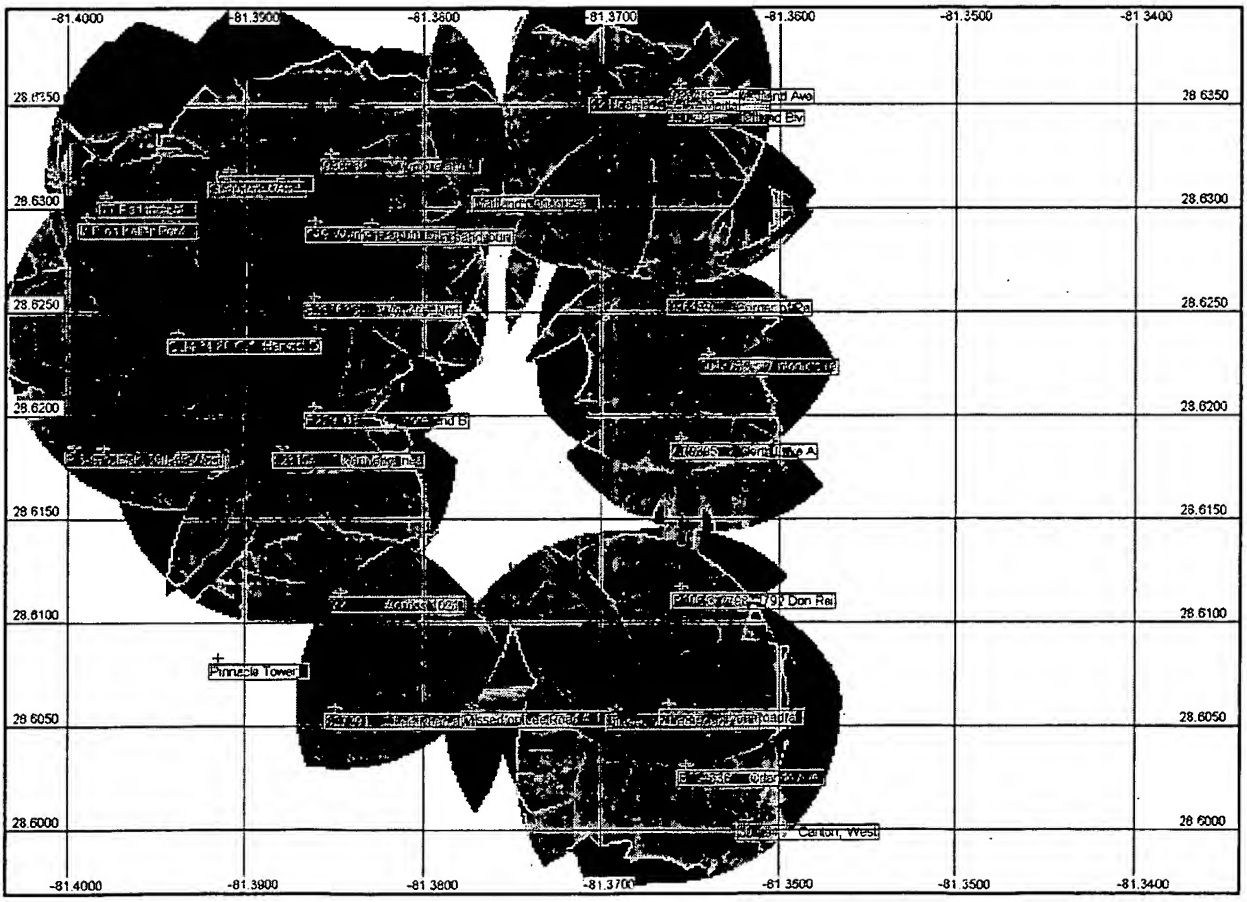


Figure 9 - Precision map of the area

Type in the name of your project, without any file extension. After clicking Save button, the project is created and the name of the project is displayed on the window title bar without the asterisk.

Clicking the left mouse button on any WR, will display WR information box.

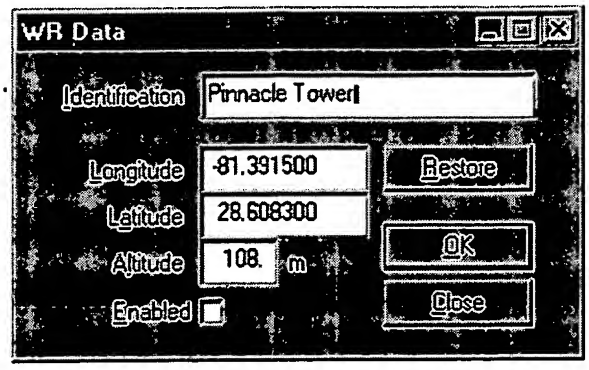


Figure 10 - WR information box

All fields in this box are editable. You can change the WR identification, longitude, latitude, altitude and you can enable or disable the WR. Also, a double click on a WR causes to change the status between enabled and disabled. Data about WR that was modified with this box is saved with the project. The Restore button can be used for returning the Longitude, Latitude and Altitude data back to the original values read from router data file.

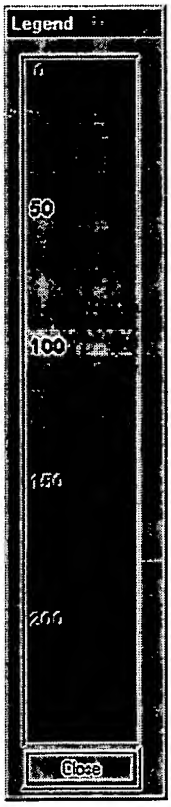


Figure 7

Every time you enable/disable a WR, the new map is computed. For saving time, the tool computes a "patch" for each WR that changes status, not the whole map.

A project that has been saved can be loaded back at anytime. The tool has protection against loosing unsaved data.

The map in Figure 9 shows the precision of location when the router in Pinnacle Tower is disabled.

The Legend of the map precision is displayed after clicking on the Legend button (the third on the status bar) or selecting it with View→Legend from main menu. Figure 7 shows the color code for Low accuracy setting (see configuration box).

If the coordinates of a WR are changed when the WR is enabled, the whole map is recomputed. For saving time it is recommended to disable the WR, move it in a new position, then to enable it back. This way the tool will compute two patches, instead of the whole map.

9 Particular configurations

The folder\\Dc1\Departments\Engineering\Task Groups\Geo\WDEPL\ contains a set of files that can be used for testing the tool.

The project "Street Deployment" shows an almost real case. There is a section of a city with 4 avenues on E-W direction (A, B, C and Interstate I) and 5 streets in N-S direction (from 1 to 5). In this configuration is an IAP at intersection between B Avenue and 3rd Street. All WRs are either at intersections of streets or along the street.

Set the configuration parameter as shown in Figure 11

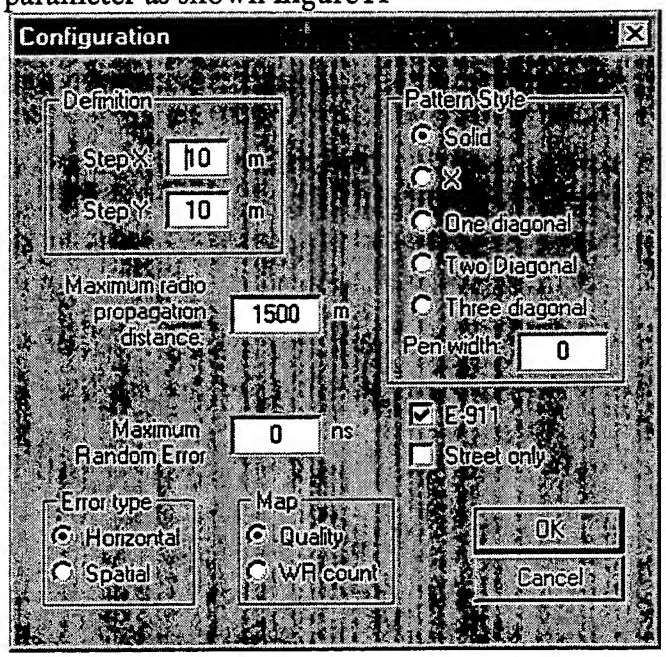


Figure 11 - Particular configuration

Load the project "Street Deployment" and let the tool compute the map. When this project is loaded, some WRs on 3rd street are enabled.

The picture shows very high precision along the 3rd street with very rapid degradation of quality when moving away from the center of the street. This phenomenon was first mentioned while testing Geolocation along Lee Road. The particularity of the configuration comes from the fact that all active WRs are in a perfect straight line.

Activating one by one the other two WRs on the 3rd street (3.3 and 3.1), the quality map changes substantially. These two routers are about 10 m, respectively 20 m, away from the line connecting all other routers.

Enabling and disabling any router would provide the map of the Geolocation quality in the affected area.

Check the other projects available from the same folder.

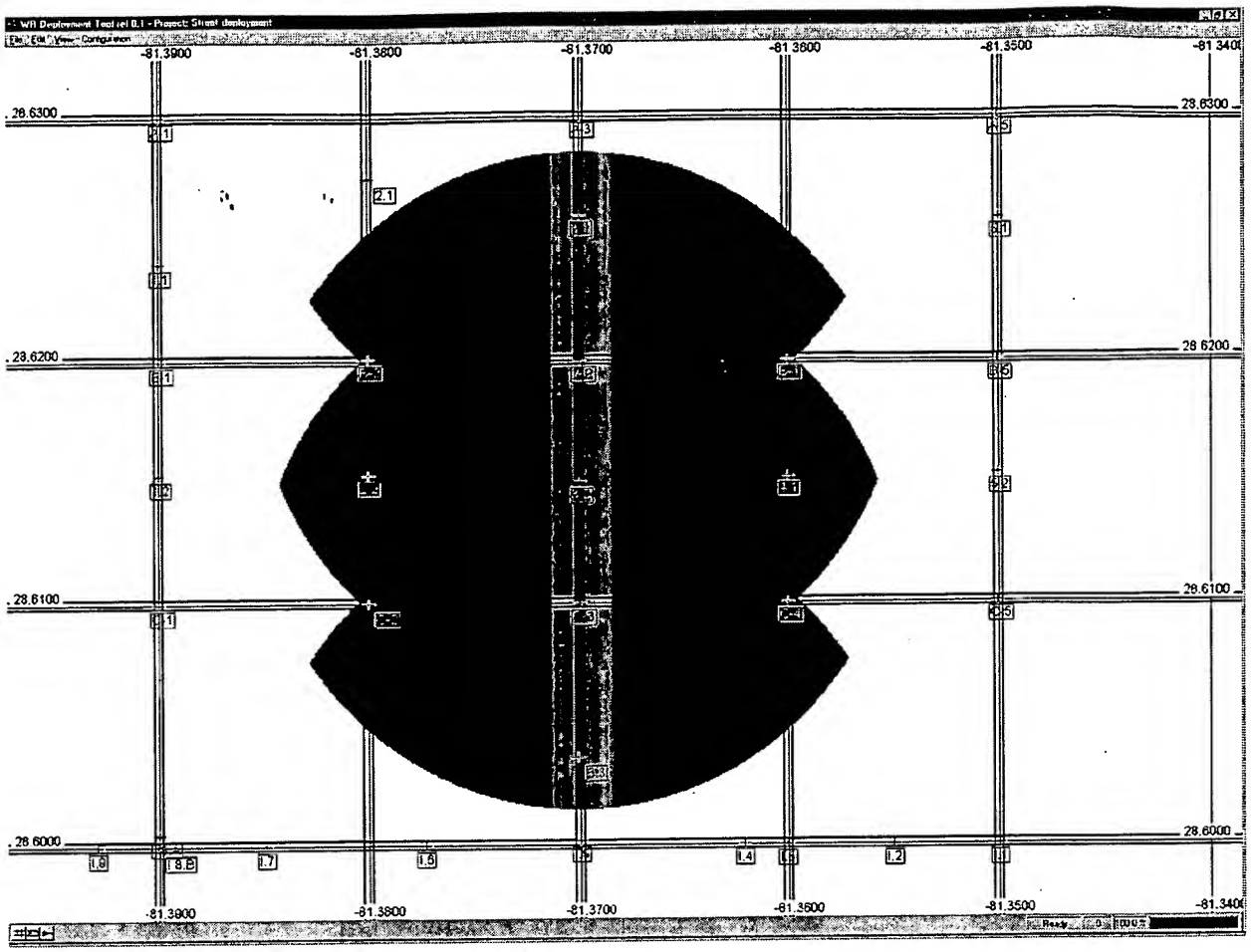


Figure 12 – location quality on 3rd street

The

10 Final Word

The WDEPL is at release 0.1 or prototype.

Your comments and suggestions for adding new capabilities will be highly appreciated.

Can youfind a better name for this tool?

MESH NETWORKS, INC.
INVENTION DISCLOSURE FORM

FOR PATENT DEPARTMENT USE ONLY

Invention Record No. 138	Title:

INVENTION RECORD

Date February 19, 2003	Project No.	Systems Engineering

This form is for the reporting any new invention or idea that might be patentable. Submit this to your Department Head or Supervisor, who will forward it to the Patent Law Department. Mesh Networks, Inc., Maitland, Florida. Its purpose is to direct attention to and make a record of new inventions. The Patent Department will acknowledge receipt of this form.

Title of Invention:

Tool for analyzing the precision of Geo-Location services in a wireless network using **mēa™** terminals.

Inventor(s) (See Instruction 1.) Note: Instructions referred to by number are printed on the Instruction Page.

(1) Name John M. Belcea	Employee No./Social Security No. 060-68-6223
Residence 2550 Ventura Circle West Melbourne, FL 32904	Citizenship U. S. A.
(2) Name	Employee No./Social Security No.
Residence	Citizenship
(3) Name	Employee No./Social Security No.
Residence	Citizenship
(4) Name	Employee No./Social Security No.
Residence	Citizenship

DESCRIPTION OF SUBJECT

I Suggested title:

Tool for analyzing the precision of Geo-Location services in a wireless network using **mēa™** terminals.

II General description:

This tool described in this document helps network infrastructure planners determine the best physical locations for MeshNetworks' Wireless Routers (WR) and Intelligent Access Points (IAP) in order to meet requirements for Geo-location accuracy.

It gives planners interactive visual feedback in evaluating placements that will optimize Geo-location coverage while minimizing infrastructure requirements.

Full description of the invention is presented as appendix A.

III The first drawing of invention are on pages (in document)

IV Literature reference is included in Appendix B

The major part of the last two pages have been left blank for description. A suggested outline for the description is included therein. Be sure to explain the subject matter fully.

The following information is desired. Please furnish it if you can. (See instruction 2.)

A. When did the described subject matter first occur to the inventor(s)? (See instruction 3.)

November 8, 2002

B. Was a drawing or sketch made and if so when? (See instruction 4.) _x__Yes ___No Date November 8, 2002

C. When was the first written description of the subject matter (other than this record) made? Date November 8, 2002

Do you have a copy of it __X__Yes _____No

D. On what date was the subject matter first disclosed to others? November 8, 2002

To whom was this disclosure made? Mike Johnson

Was it oral or written? Written Where was it made? MeshNetworks

E. If this subject matter has been described orally or in writing to persons outside of the Company, or samples have been submitted to them, please state the name of such persons and the place and date.

no

F. Has the thing or idea which you have described in this record been tried experimentally? _X_Yes ___No

Used in Company Operations?	_X__Yes	___No
Disclosed to or discussed with anybody outside the Company?	____Yes	_X_No
Sold or offered for sale?	____Yes	_X_No

If any answer is "Yes" state full details on page 2 of this record at place indicated. (See instruction 6.)

G. Were any funds from government grants or research contracts employed in the development of this subject matter? ____Yes _X_No

DETAILED ANSWER TO ITEM F

If the thing or idea described has been tried, used or offered for sale, briefly state here the dates of such trial, where used or to whom offered or sold, and the present status.

no

Name of persons who witnessed trial and testing of the subject matter and could, of their own knowledge, testify to what was done.

Mike Johnson, Eric Whitehill

Please have two witnesses who can understand its subject matter read it and sign as indicated.

We have read this Invention Record Form and understand its subject matter this 4 day of April, 2001.

Signature of Witness	Signature of Witness
Name (Please Print)	Name (Please Print)

APPROVAL OF SUPERVISOR AND DEPARTMENT HEAD

Signature	Signature
Name (Please Print)	Name (Please Print)
Title	Title

APPENDIX A

1 Introduction

This document describes the mēa Network Geo-Location Analysis Tool (NGLAT). This tool helps network infrastructure planners determine the best physical locations for MeshNetworks' Wireless Routers (WR) and Intelligent Access Points (IAP) in order to meet requirements for Geo-location accuracy. It gives planners interactive visual feedback in evaluating placements that will optimize Geo-location coverage while minimizing infrastructure requirements.

The software tool can be run in any WINDOWS operating system released after 1995.

2 Installation

To install the tool simply copy the file NGLAT.EXE into any folder on the PC.

To run the tool, double-click on the NGLAT.EXE file icon in the Windows file manager, or use WINDOWS functions to create an icon on the desktop, put it into the Start Menu or onto a quick-launch bar.

While it runs the application creates and maintains a NGLAT.INI file in the WINDOWS folder. The file contains the configuration settings that will be used next time when the application is started.

3 Quick Start

When the NGLAT is first started, the application presents an empty window with a menu bar located at the top. A set of quick operation buttons and the status of the tool are located at on the bottom of the window, as shown in Figure 1.

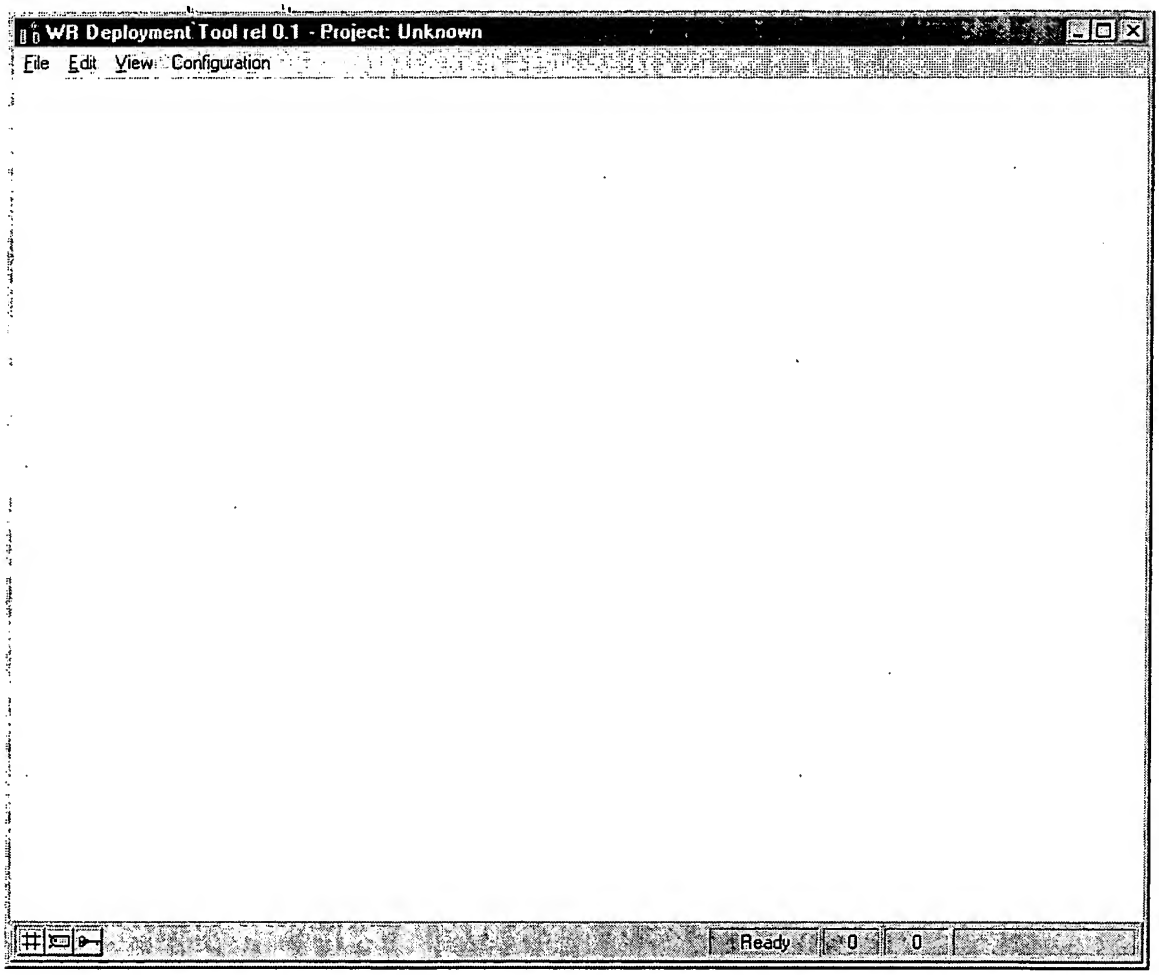


Figure 1. Main Window

4 Using the Menu

The menu has four entries: **File**, **Edit**, **View** and **Configuration**.

4.1 File

4.1.1 File->New->Project

Use this menu entry to create new empty projects. A new project does not have any WR or street information.

4.1.2 File->New->Router

When this entry is selected a "WR data" dialog box pops up, and a new router is created as shown in Figure 2.

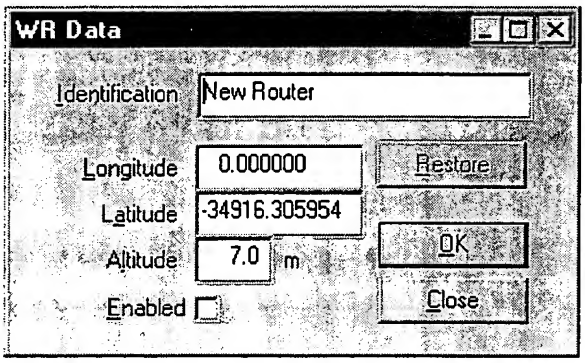


Figure 2 Data for New Router

Router coordinates are initially set at the current location (see more about location in below explanation), and assumed at 7-meters elevation. The default name of the new router is "New Router". The new router is initially disabled (the "Enabled" box is not checked). The "WR data" dialog box shows these defaults, and can be used to rename, move, and enabled the new router.

4.1.3 File->Load Project

Use this entry to load an existing project as shown in Figure 3. If you have made changes to the currently active project, you'll get a dialog box asking if you want to save your current work. The "Open project" dialog box is then opened to select a project file from the local drive or from LAN.

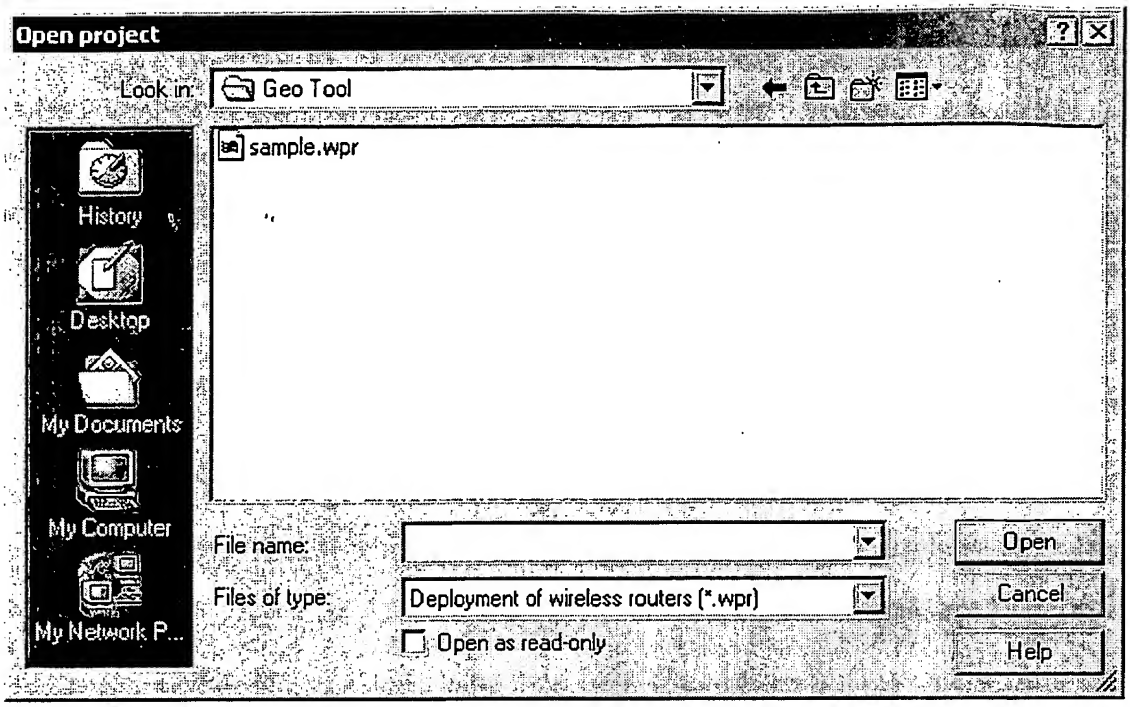


Figure 3. Open Project

4.1.4 File->Import Router Data

Use this entry to add router data to the current project. When the menu entry is selected, the dialog box "Import Data for Wireless Routers" is displayed as shown in Figure 4:

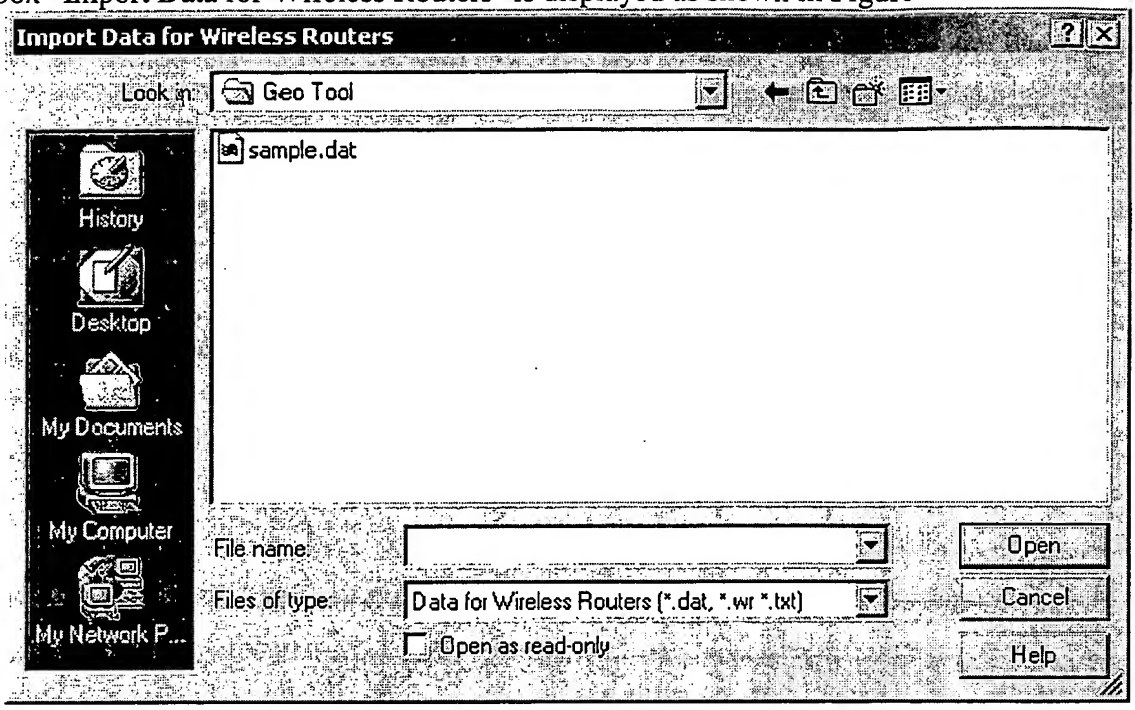


Figure 4. Import Router Data

Files of information about routers are text files with one-line router definitions. A router definition has four fields, in the following order: longitude, latitude, height, and description (name), as shown in the example below. The name must be less than 32 characters. The fields are separated by at least one space or tab character (a format output by most spreadsheet software). Lines beginning with "#" and blank lines are ignored.

```
#  lon          lat          height(m)    description
-81.36398      28.62299        7         6043735     Antonio's restaurant
```

Clicking on the "**Open**" button will import data about routers from the selected file. Imported data is added to already existing routers.

4.1.5 File->Import Street Map

Use this entry to import data about streets in planning area as shown in Figure 5. A street map is may be imported to speed up the computation process when the quality of the Geo-location is important only on streets, not within blocks between streets.

Each line in this file contains the description of a street, as shown in the example below. The fields, which must be in the following order, are the geographical coordinates of both ends of the street, the street width, and a description of 32 characters or less. The fields are separated by at least one space or tab character (a format readily output by most spreadsheet software). Lines beginning with "#" and blank lines are ignored.

```
#                                STREET LIST
#     from                       to
#lon          lat          lon          lat      width    Description
-81.3655     28.637     -81.3655     28.600      40      Maitland Ave & US Hwy 17
```

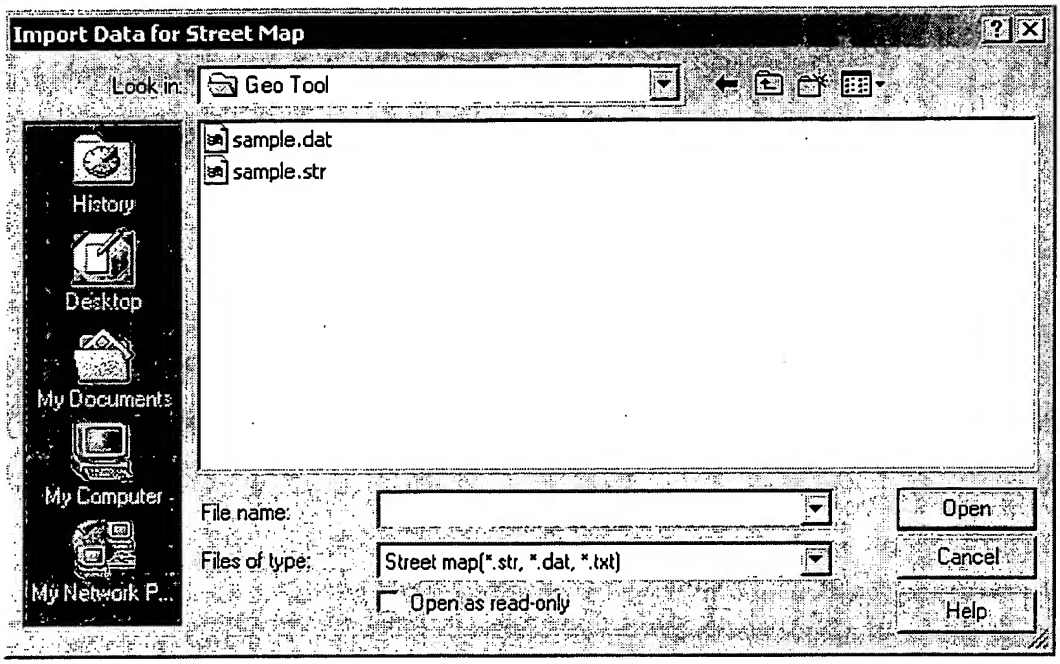


Figure 5. Import Street Map

4.1.6 File->Save Project

Use this menu entry to save the current project to a file.
The name of the project is displayed in the title bar of the main window. A new project (created with "New Project" menu entry) does not have a name. If the project does not have a name yet, "Unknown" is displayed. If any change has been made to the project since it was last saved, the name of the project in main window title bar is followed by a star. After the project is saved, the star is removed from the title bar.

If you try to save an "Unknown" project, the tool activates the file naming dialog box shown below in Figure 6.

4.1.7 File->Save Project As...

Use this menu entry to set or change the name of a project as shown in Figure 6.

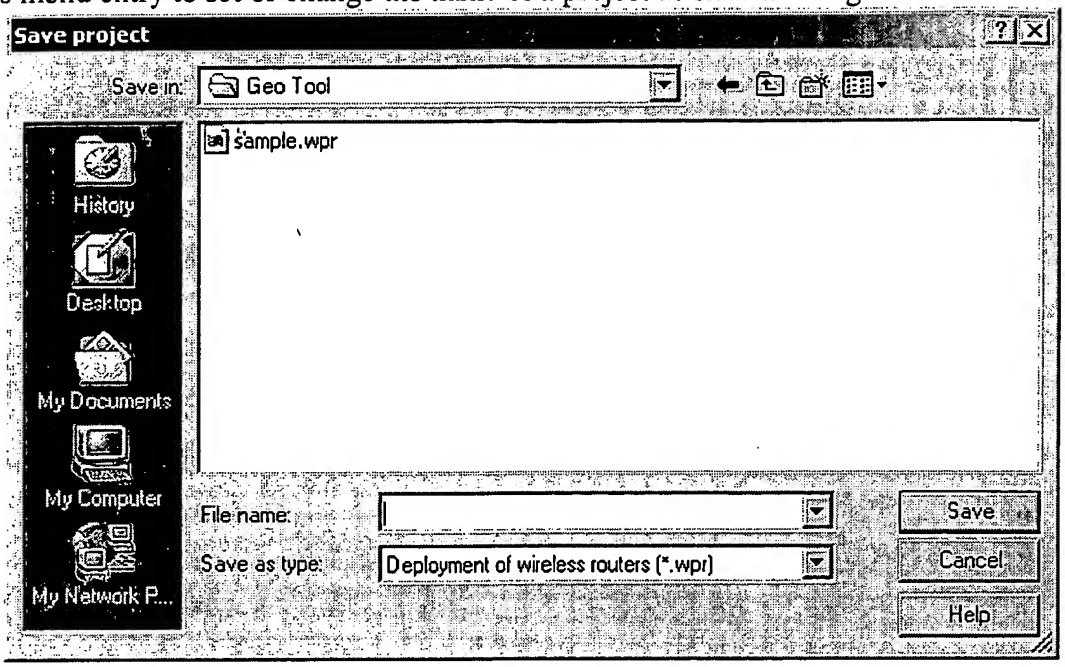


Figure 6. Save Project

Type in the name of your project in the File Name text box and click the "**Save**" button.

4.2 Edit

4.2.1 Edit->Copy

Use this menu entry to copy a project image from the screen to Windows clipboard in the device independent bitmap (DIB) format. From the clipboard, the picture can then be imported in a document, presentation, etc.

4.2.2 Edit->Delete Router

Use this menu entry to remove the currently selected router. To select a router, click on the router sign. The WR Data dialog box is opened showing the information about the currently selected wireless router.

4.3 View

4.3.1 View->Labels

With this menu entry, the view of the router labels can be turned On and Off. The same effect can be achieved by pressing the ***label*** button in the tool bar.

4.3.2 View->Grid

Use this menu entry to view or hide the geographic grid. The same effect can be achieved by pressing the ***grid*** button in the tool bar.

4.3.3 View->Legend

This entry is used for displaying the legend window. The legend window can also be displayed by pressing the ***legend*** button in the tool bar.

4.4 Configuration

Use this entry to display the "Configuration dialog box, where you can enter the system configuration data shown in Figure 7.

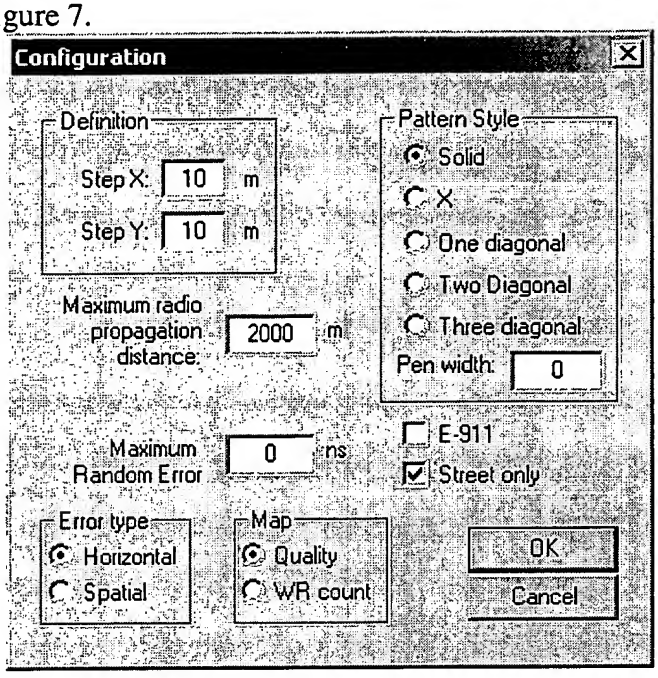


Figure 7. Configuration

4.4.1 Configuration: Definition

Use this information to specify the step size used to scan the geographical area in calculating Geo-location coverage. In each step, the software will compute the distance between the true position and the position provided by LS algorithm. The difference between these two positions is the expected calculation error, and is plotted in a specific color as a rectangle.

4.4.2 Configuration: Step X

Use this entry to set the definition on East-West (OX) direction.

4.4.3 Configuration: Step Y

Use this entry to set the definition on North-South (OY) direction.

4.4.4 Configuration: Pattern Style

The rectangle can be filled with the color corresponding to the expected calculation error using different weight patterns. The Solid pattern covers the scanning rectangle completely and is 100% opaque. Other patterns provide various levels of transparency, depending on the size of the scanning rectangle.

4.4.5 Configuration: Maximum Propagation Distance

Use this entry to set the limits of communication for GEOSERVICES purposes. Because Geo-location requires a communication link with reliability not smaller than 10%, the propagation

distance for this service is much larger than the propagation distance for data transfer, which requires at least 90% link reliability.

4.4.6 Configuration: Maximum Random Error

The Time of Flight (TOF) is affected by random errors. This entry sets the maximum error that can affect the TOF. We suggest that this error is 30-50 ns outside buildings, and 100-150 ns inside buildings. We expect that upcoming software versions with improved TOF calculation will lower these limits.

4.4.7 Configuration: E-911

The error map can be drawn with high or low precision. If this box is checked, the map shows errors from 0 m to 250 m, which makes easy to identify if E-911 requirements are met. If this box is not checked, the map shows errors between 0 m and 25 m.

4.4.8 Configuration: Street Only

This check box is available only if the project contains street data. When it is checked, the location errors are computed only for street area. It allows the computation to be performed much faster.

4.4.9 Configuration: Error Type

The displayed error can be the distance between the true point and computed point in two-dimensional (horizontal) or in three-dimensional space.

When the ***Horizontal*** button is checked, the map shows the distance between the true position and the computed position in the horizontal plane.

When the ***Spatial*** button is checked, the map shows the distance between the true position and the computed position in three-dimensional space.

4.4.10 Configuration: Map

The tool can show the map of errors or the number of routers that can be received in any scanned point.

When the ***Quality*** button is checked, the map shows the distances in scanned area.

When the ***WR Count*** button is checked, the map shows the number of routers that can be received in any point of the scanned area.

4.4.11 Configuration: OK Button

While the Configuration dialog box is open, the computation is stopped. Clicking the ***OK*** button will change the configuration according with actual settings and will close the dialog. If any of the configuration settings were changed, the computation starts from the beginning.

4.4.12 Configuration: Cancel Button

Use the ***Cancel*** button to closing the dialog box without updating any configuration elements.

5 Tool Bar

The tool bar has three buttons.

The first button  can be used to control the display of the map grid.

The second button  can be used for controlling the display of the WR labels.

The third button  launches the Legend window.

6 Status Bar

The Status bar on the lower right-hand side of the window shows four boxes of information about the computation status or the current action, the element being computed, the percent completed, and a progress bar that tracks completion.

The computation status box can show **Computing**, **Patching**, or **Ready**.

The Computing indicator is displayed when the program computes data for the whole map.

Enabling or disabling a WR, causes computation of a "patch" including the WR and covering an area up to the propagation distance. The "patching" text is displayed when the program computes a patch of the map.

When the computation is completed, the box shows "**Ready**".

The second box shows the element that is being computed. When the program computes the whole map, this indicator shows "Main". When the program computes a patch, the program shows the number of the patch that is currently being computed.

The third indicator shows the percentage completed by the currently executing computation.

The last indicator is a progress bar showing the level of completion of the currently executing computation.

7 Legend Window

The scale of the Legend window depends on map type. The legend for maps of location quality with E-911 flag turned on shows distances up to 250 m. The legend for maps of location quality with E-911 flag turned off shows distances up to 25 m.

Figure 8. Legend

The Legend for WR count maps shows values up to 10 counts. In all cases, values equal to or larger than the maximum value are presented in red color.

8 Working with the Application

The software comes with a set of files that can be used for learning to use the tool, as described below.

When starting the application the screen is blank, because no data is available.

To creating the first project, import WR data from provided Sample.dat file. Click on *File→Import router data*, then chose the file Sample.dat containing WR data.

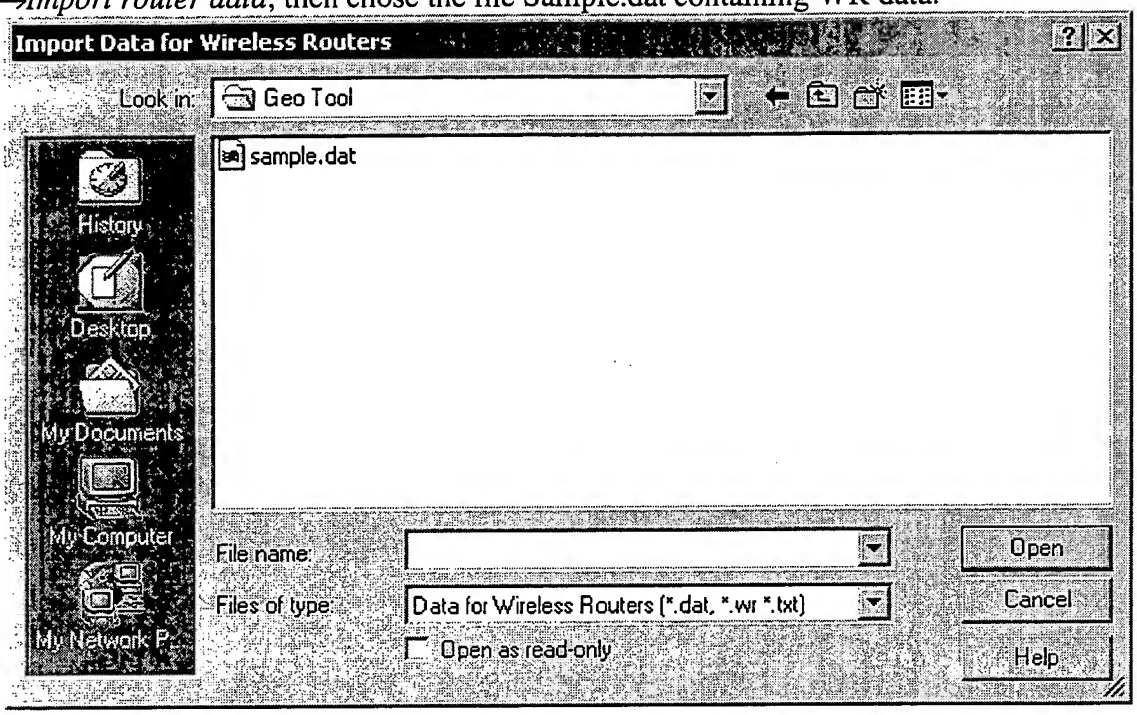


Figure 9. Import WR Data

After reading the WR description file, NGLAT shows the routers and the geographic grid. You can change configuration parameters during the computation of the map. If your change affects the way the map is displayed, the map computation will start from the beginning. Resizing the NGLAT window should also restart the map computation.

The window title bar shows the release number of WR deployment tool and the project name. If the current project was modified, an asterisk is displayed next to project name.

You can chose ***Save*** or ***Save As*** to save the project.

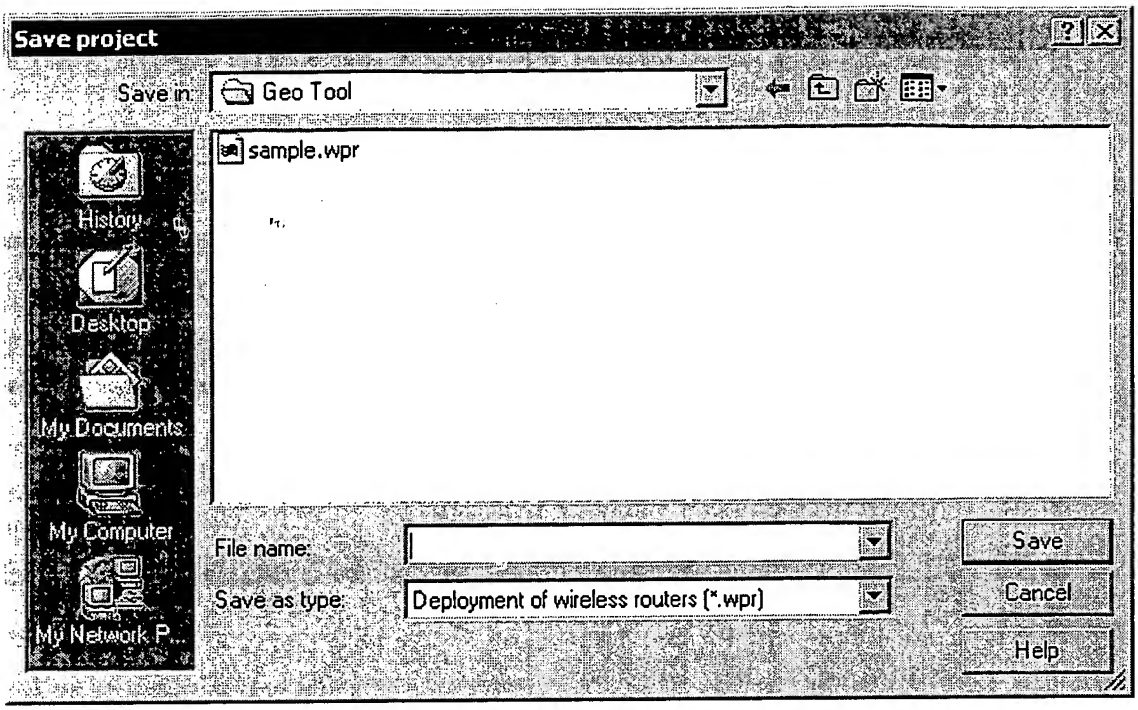


Figure 10. Save Project

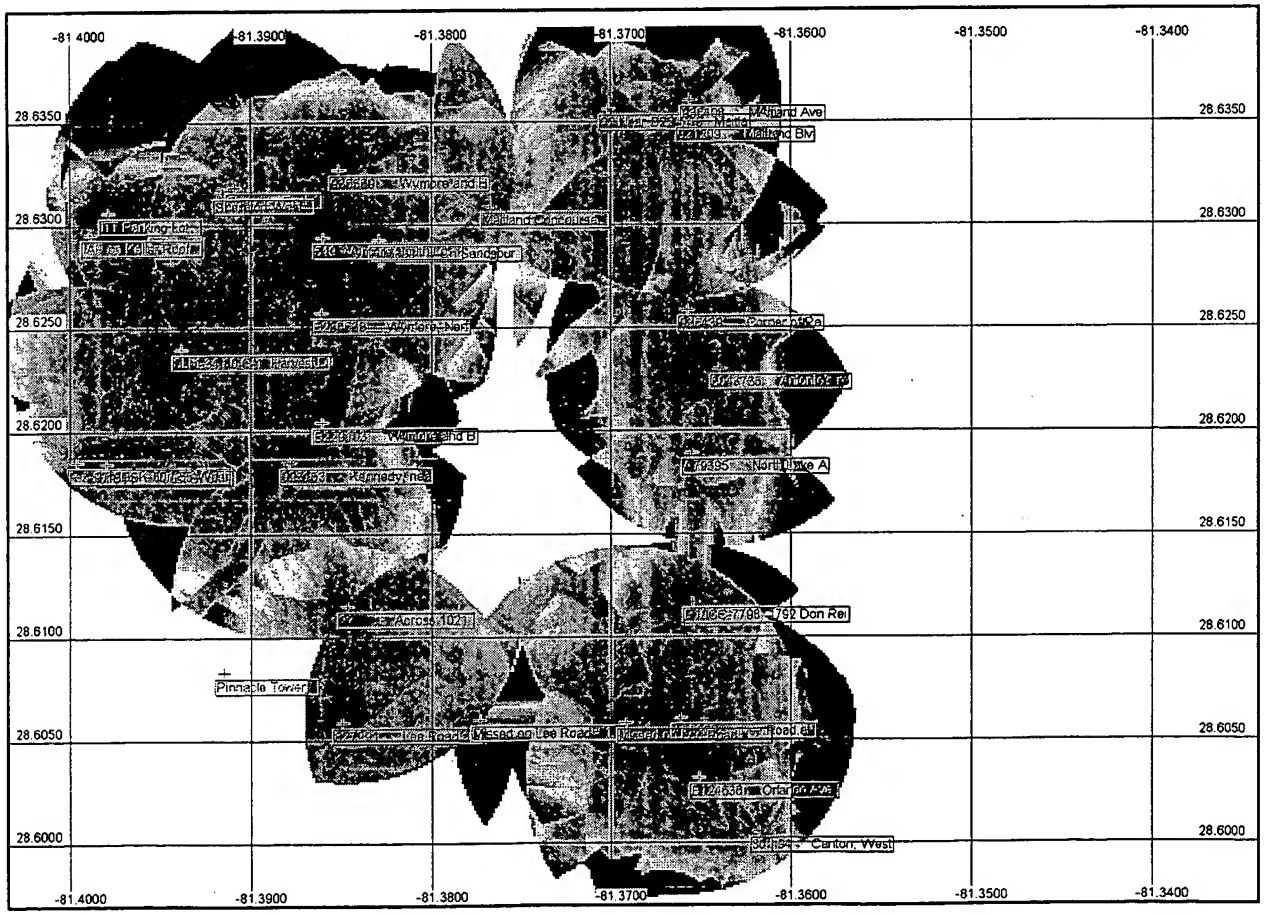


Figure 11. Precision Map of the Area

Enter the name of your project, without a file extension. After clicking on **Save** button, the project is created and the name of the project is displayed on the window title bar without the asterisk.

Clicking the left mouse button on any WR displays WR information box as shown in Figure 12.

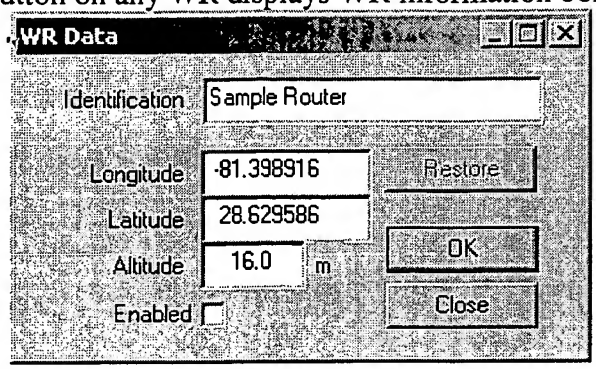


Figure 12. WR Information Box

All fields in this box are editable. You can change the WR identification, longitude, latitude, and altitude. You can also enable or disable the WR. Double-clicking on a WR causes it to toggle between enabled and disabled. Data about WR that was modified with this box is saved with the project. The ***Restore*** button can be used to return the *Longitude, Latitude,* and *Altitude* data back to the original values read from router data file.

Every time you enable/disable a WR, the new map is computed. To save time, the tool computes a "patch" for each WR that changes status, not the whole map.

A project that has been saved can be loaded back at anytime. The tool provides protection against the loss of unsaved data.

The map in Figure 11 shows the precision of location when the router on the Pinnacle Tower is disabled.

The Legend of the map precision is displayed by clicking on the Legend button (the third button on the status bar) or by selecting it using *View→Legend* from main menu.

If the coordinates of a WR are changed when the WR is enabled, the whole map is recomputed. To save time it is recommended that you disable the WR, move it in a new position, then to enable it again. This way the tool will compute two patches, instead of the whole map.

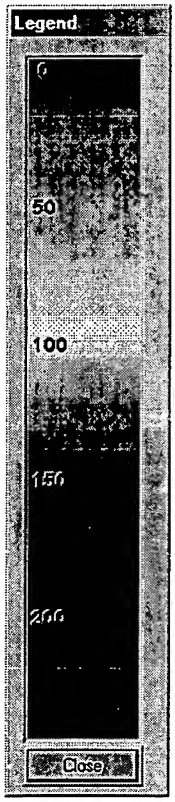


Figure 7

9 Particular Configurations

The project "Street Deployment" shows a case in which coverage is to include only the streets and not the blocks between. There is a section of a city with 4 avenues on E-W direction (A, B, C and Interstate I) and 5 streets in N-S direction (from 1 to 5). In this configuration, there is an IAP at the intersection between B Avenue and 3rd Street. All WRs are either at the intersections of streets or along the street.

Set the configuration parameter as shown in Figure 13.

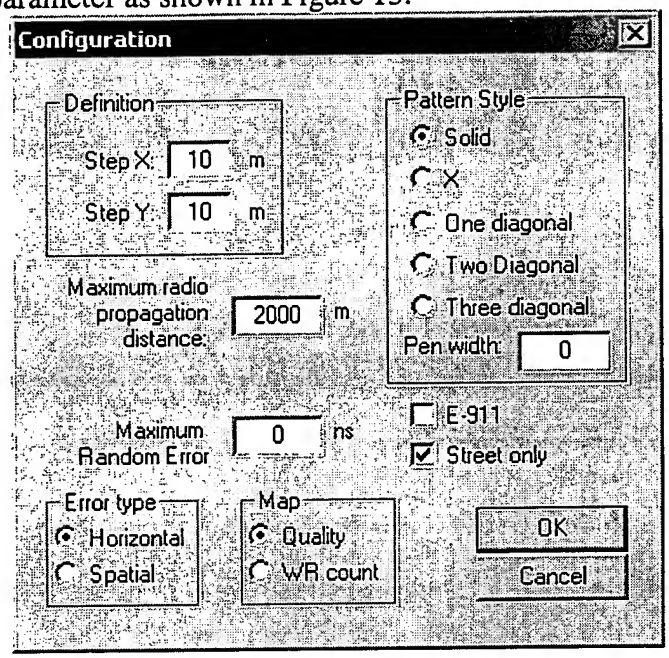


Figure 13. Particular Configuration

Load the project "Street Deployment" and let the tool compute the map. When this project is loaded, some WRs on 3rd street are enabled.

The picture shows very high precision along the 3rd street with rapid degradation of location quality when moving away from the center of the street, because all of the active WRs are in a straight line.

By activating, one by one, the other two WRs on the 3rd street (3.3 and 3.1), you will notice that the location quality on the map changes substantially. These two routers are not in line with the other routers: they are about 10 meters, 20 meters respectively from the line connecting all other routers.

Enabling and disabling any router will show the effect of this change on quality of Geo-location in the area around that router.

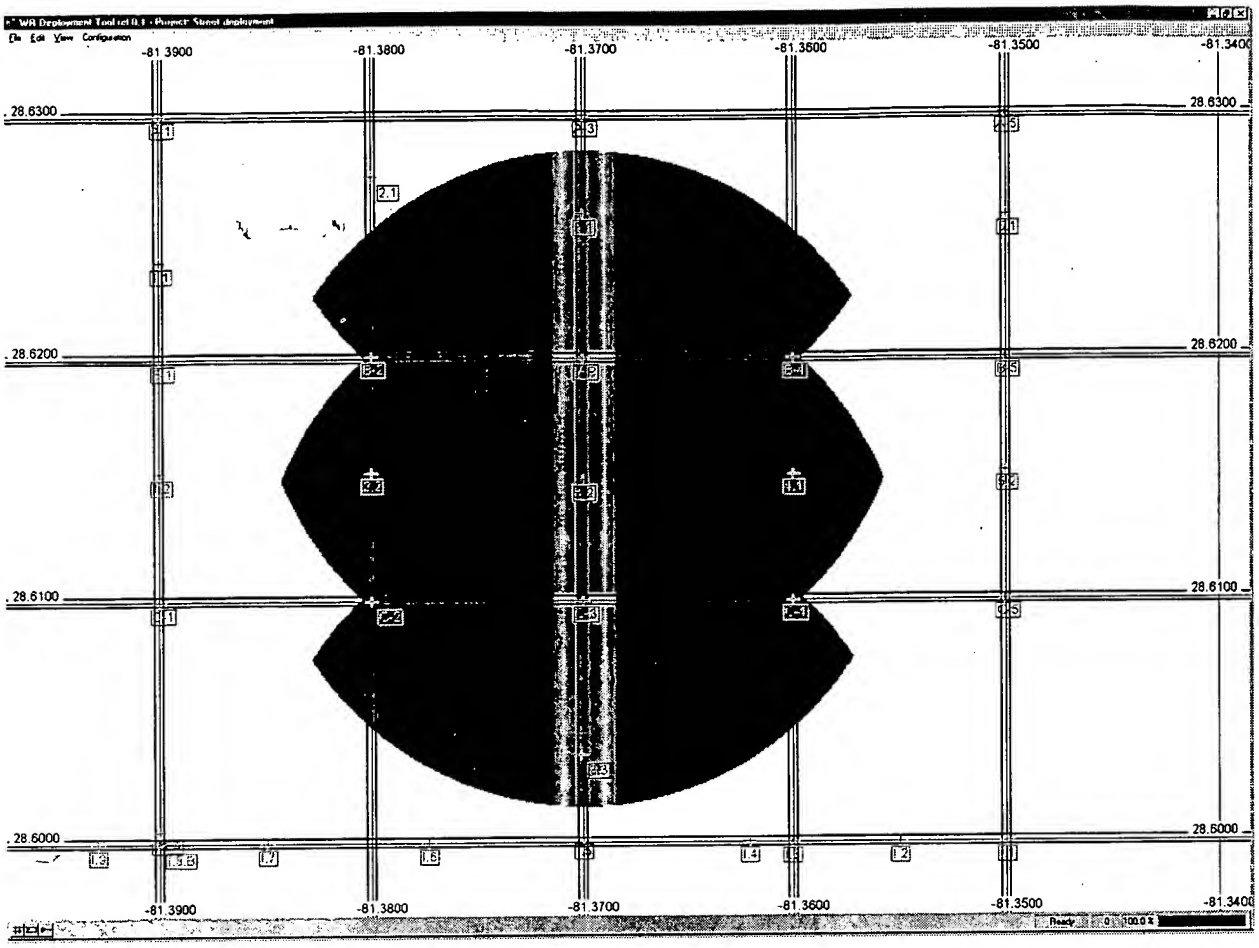


Figure 14. Location Quality on 3rd Street

APPENDIX B

BIBLIOGRAPHY